

ANNUAL REPORT

Iowa Highway Research Board

Research and Development Activities

FY 2018



DECEMBER 2018

**ANNUAL REPORT
OF
IOWA HIGHWAY RESEARCH BOARD
RESEARCH AND DEVELOPMENT ACTIVITIES**

**FOR THE
FISCAL YEAR ENDING JUNE 30, 2018**

OFFICE OF RESEARCH AND ANALYTICS
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STRATEGIC PERFORMANCE DIVISION
IOWA DEPARTMENT OF TRANSPORTATION
AMES, IOWA 50010

DECEMBER 2018

TABLE OF CONTENTS

	Page
Research and Development.....	2
Iowa Highway Research Board	2
Table I - Iowa Highway Research Board Members 2017.....	3
Table II - Iowa Highway Research Board Members 2018	5
Table III - Financial Summary of Research and Development Project Expenditures	7
Secondary Road Research Fund	9
Street Research Fund	10
Primary Road Research Fund	10
Projects Initiated During FY 2018.....	11
Projects Completed During FY 2018.....	12
State Transportation Innovation Council.....	13

LIST OF ACRONYMS

AASHTO - American Association of State Highway and Transportation Officials
APWA - American Public Works Association
ASCE - American Society of Civil Engineers
DOT - Department of Transportation
FHWA - Federal Highway Administration
GIS - Geographic Information System
HMA - Hot Mix Asphalt
HPC – High Performance Concrete
IHRB - Iowa Highway Research Board
ISU - Iowa State University
LiDAR – Light Detection and Ranging
LRFD - Load and Resistance Factor Design
LTAP - Local Technical Assistance Program
LVR - Low Volume Road
MOVITE - Missouri Valley Section of the Institute of Transportation Engineers
NCHRP - National Cooperative Highway Research Program
STIC – State Transportation Innovation Council
SUDAS - Statewide Urban Designs and Specifications
TAC - Technical Advisory Committee
TRB - Transportation Research Board
UHPC - Ultra High Performance Concrete
USGS - United States Geological Survey
WMA – Warm Mix Asphalt
SPR - Statewide Planning and Research
AADT - Annual Average Daily Traffic
RFIDS – Motion Sensing Radio Transponders
CBM – Condition-Based Maintenance
MEMS – Micro Electra Mechanical Sensor
LRFR – Load and Resistance Factor Rating
RCB – Reinforced Concrete Box
QA – Quality Assurance
DNR – Department of Natural Resources
FWD – Falling Weight Deflectometer
DCP – Dynamic Cone Penetrometer
NBIS – National Bridge Inspection Standards
OBS – Office of Bridges and Structures
BEC – Bridge Engineering Center
BBR – Bending Beam Rheometer
LOS – Level of Service
VE – Viscoelastic
FEA – Finite Element Analysis
LRFR – Load and Resistance Factor Rating

RESEARCH AND DEVELOPMENT

The Iowa DOT's Research section is dedicated to *driving a quality research program that delivers targeted solutions for Iowa's transportation future.*

This report, entitled "Iowa Highway Research Board Research and Development Activities FY2018" is submitted in compliance with Sections 310.36 and 312.3A, Code of Iowa, which direct the submission of a report of the Secondary Road Research Fund and the Street Research Fund, respectively. It is a report of the status of research and development projects in progress on June 30, 2018. It is also a report on projects completed during the fiscal year beginning July 1, 2017 and ending June 30, 2018. Detailed information on each of the research and development projects mentioned in this report is available from the Office of Research and Analytics, Performance and Technology Division, Iowa Department of Transportation.

THE IOWA HIGHWAY RESEARCH BOARD

In developing a progressive, continuing, and coordinated program of research and development, the Iowa DOT is assisted by the IHRB. This advisory group was established in 1949 by the Iowa State Highway Commission to respond to the research denoted in Sections 310.36 and 312.3A of the Code of Iowa.

The Research Board consists of 15 regular members: seven Iowa county engineers, four Iowa DOT engineers, one representative from Iowa State University, one from The University of Iowa, and two engineers employed by Iowa municipalities. Each regular member may have an alternate who will serve at the request of the regular member. The regular members and their alternates are appointed for a three year term. The membership of the Research Board for FY18 is listed in Tables I and II.

The Research Board held several regular meetings during the period from July 1, 2017, through June 30, 2018. Suggestions for research and development were reviewed at these meetings and recommendations were made by the Board.



Members of the IHRB are serious about the future of transportation. Understanding that every research project has the potential to strengthen the infrastructure and save lives, time, and precious resources, they work hard to make sure new methods, technologies, and materials are developed efficiently and economically for application in the real world. **The IHRB has received national attention as a leader in transportation research implementation.**

Table I - 2017 IOWA HIGHWAY RESEARCH BOARD

<u>Member</u>	<u>Term Expires</u>	<u>Alternate</u>
Ahmad Abu-Hawash, Chair Chief Structural Engineer, Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1393 Ahmad.Abu-hawash@iowadot.us	12/31/2018	Dave Claman Preliminary Bridge Engineer, Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1487 David.Claman@iowadot.us
Kevin Jones Materials Testing Engineer, Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1237 Kevin.Jones@iowadot.us	12/31/2018	Chris Brakke Pavement Management Engineer 800 Lincoln Way Ames, IA 50010 (515) 239-1882 Chris.Brakke@iowadot.us
Chris Poole Safety Programs Engineer, Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1267 Chris.Poole@iowadot.us	12/31/2019	Khyle Clute Methods Transportation Engineer 800 Lincoln Way Ames, IA 50010 (515) 239-1862 Khyle.Clute@iowadot.us
Tammy Nicholson Director, Office Location & Environment, Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1052 Tamara.Nicholson@iowadot.us	12/31/2017	Dan Sprengeler Work Zone Traffic Control Engineer, Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1823 Dan.Sprengeler@iowadot.us
Sarah Okerlund, Civil Engineer II, City of Ankeny 220 W 1st St Ankeny, IA 50023-1751 (515) 963-3526 sokerlund@ankenyiowa.gov	12/31/2017	Matt Cox City Engineer, City of Council Bluffs 209 Pearl Street Council Bluffs, IA 51503-0826 (712) 328-4635 mcox@councilbluffs-ia.gov
Ronald Knoche Director of Public Works, Iowa City 410 E. Washington Street Iowa City, IA 52240-1825 (319) 356-5138 Ron-Knoche@iowa-city.org	12/31/2018	Bruce Braun Street Maintenance Administrator, Des Moines 216 SE 5th Street Des Moines, IA 50309 (515) 237-1371 BABraun@dmgov.org
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Terry Wipf Iowa State University, Dept. of CCEE 420 Town Engineering Bldg. Ames, IA 50011 (515) 294-6979 TJWipf@iastate.edu	-----	

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Table II - 2018 IOWA HIGHWAY RESEARCH BOARD

<u>Member</u>	<u>Term Expires</u>	<u>Alternate</u>
Ahmad Abu-Hawash Chief Structural Engineer, Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1393 Ahmad.Abu-hawash@iowadot.us	12/31/2018	Dave Claman Preliminary Bridge Engineer, Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1487 David.Claman@iowadot.us
William Dotzler Materials Engineer, District 3 Iowa DOT 2800 Gordon Drive Sioux City, IA 51102 (712) 239-4713 William.Dotzler@iowadot.us	12/31/2021	Chris Brakke Pavement Management Engineer 800 Lincoln Way Ames, IA 50010 (515) 239-1882 Chris.Brakke@iowadot.us
Chris Poole Safety Programs Engineer, Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1267 Chris.Poole@iowadot.us	12/31/2019	Daniel Harness Office of Design, Methods Section 800 Lincoln Way Ames, IA 50010 (515) 239-1727 Daniel.Harness@iowadot.us
Tammy Nicholson Director, Office Location & Environment 800 Lincoln Way Ames, IA 50010 (515) 239-1052 Tamara.Nicholson@iowadot.us	12/31/2020	Dan Sprengeler Work Zone Traffic Control Engineer, Iowa DOT 800 Lincoln Way Ames, IA 50010 (515) 239-1823 Dan.Sprengeler@iowadot.us
Sarah Okerlund, Civil Engineer II, City of Ankeny 220 W 1st St Ankeny, IA 50023-1751 (515) 963-3526 sokerlund@ankenyiowa.gov	12/31/2020	Matt Cox City Engineer, City of Council Bluffs 209 Pearl Street Council Bluffs, IA 51503-0826 (712) 328-4635 mcox@councilbluffs-ia.gov
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RESEARCH AND DEVELOPMENT PROJECTS

Proposals for research and development are reviewed by the Iowa Highway Research Board. Expenditure of research and development funds are then authorized on an individual project basis.

These expenditures may be charged to the Primary Road Research Fund, Secondary Road Research Fund or the Street Research Fund, or a combination and the costs are shared.

Table III is a record of expenditures for IHRB Projects made during the fiscal year ending June 30, 2018. Total expenditure was \$2,335,114.76.

TABLE III
FINANCIAL SUMMARY OF RESEARCH AND DEVELOPMENT PROJECT EXPENDITURES

July 1, 2017 to June 30, 2018

(Active projects with no current fiscal year expenditures are not included)

Project #	Project Title	Primary Road Research Fund Expenditures	Secondary Road Research Fund Expenditures	Street Research Fund Expenditures	Total Expenditures
HR140	Collection & Analysis of Streamflow Data	\$ 156,738.00	\$ 78,102.00		\$ 234,840.00
HR296	ISU Local Technical Assistance Program (LTAP)	\$ 68,144.04	\$ 85,180.06	\$ 17,036.00	\$ 170,360.10
HR-1027	Secondary Road Research Support		\$ 37,382.48		\$ 37,382.48
TR-375	Transportation Research Board Education for County Engineers		\$ 8,450.24		\$ 8,450.24
TR-613	Study of the Impacts of Implements of Husbandry on Iowa Bridges	\$ 480.53			\$ 480.53
TR673	Design and Performance Verification of a Bridge Column/Footing/Pile System for Accelerated Bridge Construction (ABC)		\$ 18,439.29	\$ 5,991.82	\$ 24,431.11
TR674	Evaluation of Otta Seal Surfacing for Low-Volume Roads In Iowa		\$ 59,045.11	\$ 17,207.37	\$ 76,252.48
TR676	Impacts of Internally Cured Concrete Paving on Contraction Joint Spacing		\$ 12,243.24		\$ 12,243.24
TR683	Bridge Workshop - Use of Ultra-High Performance Concrete for Bridges		\$ 2,784.69		\$ 2,784.69
TR684	Laboratory and Field Evaluation of an Alternative UHPC Mix and an Associated UHPC Bridge		\$ 14,737.37		\$ 14,737.37
TR685	Feasibility of Gravel Road and Shoulder Recycling		\$ 30,008.47	\$ 14,983.89	\$ 44,992.36
TR691	Cost-Competitive Timber Bridge Designs for Long Term Performance	\$ 29,377.17			\$ 29,377.17
TR692	Investigation of Stream-Channel and Watershed Delineations and Basin-Characteristic Measurements using LiDAR Data for Small Drainage Basins in Iowa Located Within the Des Moines Lobe Landform Region			\$ 8,750.00	\$ 8,750.00
TR695	Evaluation of Rural Intersection Treatments			\$ 5,962.31	\$ 5,962.31

TR698	Concrete Overlay Performance on Iowa's Roadways	\$ 54,168.64	\$ 36,062.23		\$ 90,230.87
TR699	Real-time Flood Forecasting and Monitoring Systems for Highway Overtopping in Iowa		\$ 23,995.01	\$ 14,952.00	\$ 38,947.01
TR700	Prevention of Longitudinal Cracking in Iowa Widened Concrete Pavement	\$ 37,241.16	\$ 57,853.87		\$ 95,095.03
TR701	Evaluation of the Use of Link Slabs in Bridge Projects	\$ 14,456.96	\$ 34,722.00	\$ 2,629.56	\$ 51,808.52
TR703	Update Depth of Cover Tables for Concrete and Corrugated Pipe			\$ 111.82	\$ 111.82
TR704	Performance Based Evaluation of cost Effective Aggregate Options for Granular Roadways		\$ 44,996.77	\$ 6,690.37	\$ 51,687.14
TR709	Effectiveness of Pavement Preservation Techniques	\$ 21,895.30	\$ 43,202.50		\$ 65,097.80
TR-710	Partially Grouted Revetment for Low Volume Road Bridges	\$ 25,479.50	\$ 6,472.82	\$ 1,294.57	\$ 33,246.89
TR-711	Investigation of Exterior Girder Rotation and the Effect of Skew during Deck Placement	\$ 25,035.44	\$ 22,702.63	\$ 5,086.11	\$ 52,824.18
TR-712	Evaluate, Modify and Adapt the Concrete Works Software for Iowa's Use	\$ 52,756.27	\$ 13,211.96		\$ 65,968.23
TR-714	Guide to Life-Cycle Data and Information Sharing Workflow for Transportation Assets	\$ 11,677.18	\$ 25,000.00	\$ 4,999.08	\$ 41,676.26
TR-715	Beam End Repair for Pre-Stressed Concrete Beams	\$ 11,355.49	\$ 24,147.52	\$ 2,766.96	\$ 38,269.97
TR-716	Construction of New substructure Beneath Existing Bridges TR-716	\$ 14,761.81			\$ 14,761.81
TR-717	Use of Polymer Overlays or Sealers on New Bridges		\$ 9,785.00	\$ 2,500.00	\$ 12,285.00
TR-718	Evaluation of Alternative Abutment Piling for Low Volume Road Bridges	\$ 15,858.04	\$ 12,953.67		\$ 28,811.71
TR-719	Development of Self-Cleaning Box Culvert Phase III	\$ 72,299.60	\$ 42,711.88		\$ 115,011.48
TR-720	Development of Bio-Based Polymers for Us in Asphalt - Phase II	\$ 65,629.45			\$ 65,629.45
TR-721	Low-cost Rural Surface Alternatives Phase III	\$ 52,846.78			\$ 52,846.78
TR-722	Increase Service Life at Bridge Ends through Improved Abutment and Approach Slab Details and Water Management Practices	\$ 29,123.89			\$ 29,123.89
TR-723	Implementation of Negative Moment Reinforcement Detail Recommendations	\$ 2,534.31			\$ 2,534.31
TR-724	Heating Electrically Conductive Concrete Demonstration	\$ 79,478.46	\$ 3,043.66		\$ 82,522.12
TR-725	Low-Cost Rural Surface Alternatives Phase IV: Forst Depth Monitoring and Prediction	\$ 107,566.68			\$ 107,566.68
TR-726	Modernization of Iowa Transportation Program Management System		\$ 23,684.33		\$ 23,684.33
TR-727	Optimizing Maintenance Equipment Life Cycle for Local Agencies	\$ 5,236.04			\$ 5,236.04
TR-728	Role of Coarse Aggregate Porosity on Chloride Intrusion in HPC Bridge Decks	\$ 50,479.76			\$ 50,479.76
TR-729	Development of Granular Roads Asset Management System		\$ 49,187.58		\$ 49,187.58
TR-731	Improving Concrete Patching Practices In Iowa Roadways	\$ 29,100.00			\$ 29,100.00

TR-732	Develop Safety Improvements at Public Highway Railroad Grade crossings	\$ 37,170.46	\$ 24,888.80	\$ 62,059.26
TR-733	Iowa Secondary Roads Research Support		\$ 113,777.01	\$ 113,777.01
TR-734	Load Rating for Short Span Prefabricated Bridge County Standards	\$ 5,944.04	\$ 4,530.84	\$ 10,474.88
TR-735	Holding Strategies for Low Volume State Routes, Phase II	\$ 20,499.39		\$ 20,499.39
TR-736	Performance Evaluation of Recent Improvement of Bridge Abutments and Approach Backfill	\$ 20,000.00	\$ 17,500.00	\$ 37,500.00
TR-737	Next Generation Life Cycle Cost Analysis Tool for Bridges in IA	\$ 26,667.51		\$ 26,667.51
TR-738	Shrinkage and Temperature Forces in Frame Piers	\$ 28,030.52		\$ 28,030.52
TR-739	Limitations for Semi-Integral Abutment Bridges	\$ 28,164.82		\$ 28,164.82
TR-740	Development of IA Pavement Analysis Technique		\$ 26,947.79	\$ 26,947.79
TR-744	Transfer of the IA DOT Culverts Web-Tool Prototype to IA DOT Mainframe	\$ 9,291.63		\$ 9,291.63
TR-746	Field Implementation of Internally Cured Concrete for Iowa Pavement Systems - TR-676 Phase II	\$ 11,868.64		\$ 11,868.64
TR-748	Characterizing the Behavior of a Machine-Placed UHPC Bridge Deck Overlay	\$ 3,019.63		\$ 3,019.63
TR-749	Impact of Curling & Warping on Concrete Pavement Systems-Phase I	\$ 2,290.98		\$ 2,290.98
Project Total		\$ 1,226,668.12	\$1,007,750.82	\$ 2,335,114.76

SECONDARY ROAD RESEARCH FUND

Section 310.34 of the Iowa Code authorizes the Iowa Department of Transportation to set aside each year an amount not to exceed 1½% of the receipts to the Farm-to-Market Fund in a fund to be known as the Secondary Road Research Fund. This authorization was first made in 1949; it was repealed in 1963, and reinstated in 1965. When the fund was reinstated, the fund was designated to finance engineering studies and research projects. The Iowa Department of Transportation accounting procedure for the Secondary Road Research Fund is based on obligations for expenditures on research projects and not the actual expenditures.

The fiscal year 2018 financial summary is:

Beginning Balance 7-1-17		\$ 1,711,289.22
Receipts		
State Road Use Tax Fund		
(1½% of receipts)	\$ 1,616,874.15	
Federal Aid Secondary		
(1½% of receipts)	0.00	
Research Income	<u>\$ 0.00</u>	
Sub-Total		\$1,616,874.15
Total Funds Available		\$3,328,163.37
Obligation for Expenditures		
Obligated for		
Contract Research	\$2,165,225.54	
Non-Contract		
Engineering Studies	<u>\$ 0.00</u>	
Total Expenditures		\$2,165,225.54
Ending Balance 6-30-18		\$1,162,937.83

STREET RESEARCH FUND

The Street Research Fund was established in 1989 under Section 312.3A of the Iowa Code. Each year \$200,000 is set aside from the street construction fund for the sole purpose of financing engineering studies and research projects. The objective of these projects is more efficient use of funds and materials available for construction and maintenance of city streets. The Iowa Department of Transportation accounting procedure for the Street Research Fund is based on obligations for expenditures on research projects and not the actual expenditures. The fiscal year 2017 financial summary is:

Beginning Balance (7-1-17)	\$10,057.18
De-obligated (Unused) Funds from Previous Projects	\$33,726.15
FY18 Street Research Funding	<u>\$200,000.00</u>
Total Funds Available for Street Research	\$243,783.33
Total Obligated for Expenditure FY18	<u>(\$239,854.50)</u>
Ending Unobligated Balance 6-30-18	\$3,929.00

PRIMARY ROAD RESEARCH FUND

The Primary Road Research Fund is sourced from non-obligated funds of the Primary Road Fund. These funds can only be expended on projects for which the funds were reserved, such as contracted research and project-specific research supplies or equipment. An estimate of Primary Road Research Fund expenditures is made prior to the beginning of each fiscal year. The amount expended for contract research from the Primary Road Research Fund for FY18 was \$1,226,668.12 and the estimate for obligations for FY19 is \$950,000.

PROJECTS INITIATED DURING FY 2018

The following projects were initiated in FY 18.

TR-733, “2018 Iowa Secondary Roads Research Support”

TR-734, “Load Rating for Short Span Prefabricated Bridge County Standards”

TR-735, “Holding Strategies for Low Volume State Routes Phase II”

TR-736, “Performance Evaluation of Recent Improvements of Bridge Abutments and Approach Backfill”

TR-737, “Next Generation Life Cycle Cost Analysis Tool for Bridges in Iowa”

TR-738, “Shrinkage and Temperature Forces in Frame Piers”

TR-739, “Limitations for Semi-Integral Abutment Bridges”

TR-740, “Development of Iowa Pavement Analysis Technique”

TR-741, “Asset Management, Extreme Weather, and Proxy Indicators”

TR-742, “Validation of Gyratory Mix Design in Iowa – Phase II”

TR-743, “Field Demonstration of an Innovative Box Beam Connection”

TR-744, “Transfer of the Iowa DOT Culverts Web-Tool Prototype to Iowa DOT Mainframe”

TR-745, “Development of Operations Management System for Iowa Secondary Road Departments”

TR-746, “Field Implementation of Internally Cured Concrete for Iowa Pavement Systems”

TR-747, “Use of Waste Quarry Fines as a Binding Material in Unpaved Roads”

TR-748, “Characterizing the Behavior of a Machine-Placed UHPC Bridge Deck Overlay”

TR-749, “Impact of Curling and Warping on Concrete Pavement Systems Phase II”

TR-750, “Comparing the design and Use of Different Types of Grande Control at Culverts”

TR-752, “Implementation of Recommendations for Eliminating Longitudinal Median Joints in Wide Bridges”

TR-753, “Otta Seal Phase II”

20 Projects Initiated

PROJECTS COMPLETED DURING FY 2018

The following projects were presented to the Iowa Highway Research board during FY 2018 and project Final Reports were approved. Links to the available final reports are provided.

TR-613, “Study of the Impacts of Implements of Husbandry on Iowa Bridges”

<http://publications.iowa.gov/25855/>

TR-652, “Analysis of Statewide Pavement Marking Program” <http://publications.iowa.gov/27296/>

TR-665, “Mitigation at Sedimentation at Multi-Box Culverts” <http://publications.iowa.gov/27032/>

TR-671, “Performance Monitoring of Boone County Expo Pavement Sections”

<http://publications.iowa.gov/27036/>

TR-674, “Evaluation of Otta Seal Surfacing for Low-Volume Roads in Iowa”

<http://publications.iowa.gov/27882/>

TR-676, “Impacts of Internally Cured Concrete Paving on Contradiction Joint Spacing”

<http://publications.iowa.gov/27038/>

TR-683, “Bridge Workshop – Use of Ultra-High Performance Concrete for Bridge Deck Overlay”

<http://publications.iowa.gov/27040/>

TR-685, “Feasibility of Gravel Road and Shoulder Recycling” <http://publications.iowa.gov/27297/>

TR-687, “Effect of Wind Induced Unsteady Vortex Shedding, Diurnal Temperature Changes, and Transit Conditions on Truss Structures Supporting Large Highway Signs” <http://publications.iowa.gov/27042/>

TR-692, “Investigation of Stream-Channel and Watershed Delineations and Basin-Characteristic Measurements using LiDAR Data for Small Drainage Basins in Iowa Located Within the Des Moines Lobe Landform Region”

<http://publications.iowa.gov/27263/>

TR-693, “Development of Quality Standards for Inclusion of High Recycled Asphalt Pavement Content in Asphalt Mixtures” <http://publications.iowa.gov/27885/>

TR-695, “Evaluation of Rural Intersection Treatments” <http://publications.iowa.gov/27883/>

TR-696, “Installation Guidance for Centerline and Edgeline Rumble Strips in Narrow Pavements”

<http://publications.iowa.gov/27043/>

TR-700, “Prevention of Longitudinal Cracking in Iowa Widened Concrete Pavement”

<http://publications.iowa.gov/27886/>

TR-717, “Use of Polymer Overlays or Sealers on New Bridges” <http://publications.iowa.gov/26124/>

15 Projects Completed and Approved

STATE TRANSPORTATION INNOVATION COUNCIL



Since 2015, the Iowa Highway Research Board serves as the *State Transportation Innovation Council* for the State of Iowa. The Federal Highway Administration (FHWA) *State Transportation Innovation Council* (STIC) Incentive program provides resources to help STICs foster a culture for innovation and make innovations standard practice. Through the program, funding up to \$100,000 of STIC Incentive Federal Funding is awarded to the State per Federal fiscal year. This funding is

available to support or offset the costs of standardizing innovative practices for Iowa's transportation agencies. STIC Incentive funding may be used to conduct internal assessments; build capacity; develop guidance, standards, and specifications; implement system process changes; organize peer exchanges; offset implementation costs; or conduct other activities the STIC identifies to address innovation implementation goals and to foster a culture for innovation or to make an innovation a standard practice in the state. The requirements for eligibility of a project or activity are:

- The project must have a statewide impact in fostering a culture for innovation or in making an innovation a standard practice.
- The project/activity for which incentive funding is requested must align with innovation goals.
- The project/activity must be eligible for Federal-aid assistance and adhere to applicable federal requirements.
- The proposed project/activity must be started as soon as practical (preferably within 6 months, but no later than 1 year) after notification of approval for STIC Incentive funding and the funds must be expended within 2 years.

The following projects have been initiated through the STIC Incentive Fund program for the State of Iowa. Links to final reports are available for completed projects:

2014, "Design and performance verification of a bridge column/footing/pile system for accelerated bridge construction"

2014, "Develop an implementation plan for using 3D tools for structural detailing"

2015, "Development and delivery of technical guidance and training on the implementation of a self-cleaning culvert technology" <http://publications.iowa.gov/27298/>

2015, "Expand the use of mobile devices for e-Construction in field inspection applications"

2016, "Expand the use of mobile devices for e-Construction in field inspection applications"

2016, "Innovations in Transportation Conference"

2016, "Deployment of Iowa DOT Traffic Operations Open Data Service" <http://publications.iowa.gov/27382/>

2017, "In Situ Modulus Measurement Using Automated Plate Load Testing (APLT) to Support The Implementation of Pavement Mechanistic-Empirical (ME) Design"